OPERATING INSTRUCTIONS

FOR

CONDUCTANCE METER

TYPE 192-A

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MP MASTER
MA24319

BOONTON RADIO CORPORATION
BOONTON, NEW JERSEY
U. S. A.

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for

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INSTRUCTION MANUAL

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INSTRUCTION MANUAL

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A. PREPARATION for INSTRUMENT OPERATION

1. Carefully unpack the equipment and be sure that no material is missing. One complete instrument consists of:

1 - 192-A Conductance Meter
1 - Plug-in-Unit 1 mc or 30 mc as specified (Installed for operation in instrument)
1 - Instruction Manual
1 - High Binding Post (Both delivered mounted on instrument
1 - Ground Binding Post in operating position)

Separately available accessories are:

a. Extra plug-in-units for either 1 mc or 30 mc operation. (Stored in instrument cabinet.)
b. Adapter kit, Type 512-A, to mount General Radio Type 1690-A Dielectric Sample Holder to the instrument.

Open the top cover which lifts at the right hand edge, (hinged on the left hand edge). Be sure that the tubes are all in their sockets in the power supply along the lower rear corner of the cabinet (4 tubes and one 110V lamp). Along the right hand edge of the chassis directly under the meter (1 tube), and along the rear edge of the R.F. chassis (4 tubes). Be certain that all inter-connection cables are in their receptacles.

The test terminals for the instrument are to be found on the bright terminal plate on the upper right hand side of the cabinet. They have been located there to keep test samples out of the way of the controls and to provide a short direct connection to the measuring circuit. Either two binding posts may be used, or special sample holder for disc-shaped dielectric specimens may be mounted on this terminal plate.

Install the binding posts on the side plate. One 1/4 inch threaded hole in the center of the protruding boss is to take either the high binding post or the center connecting male plug for use when a dielectric sample holder is mounted.

There are three 1/4 inch threaded holes spaced at 120° intervals about the high terminals, any of which may be used for the ground binding post.

Four 6-32 threaded holes on the low terminal plate and centered on the high terminal are ordinarily used to support the dielectric sample holder, but may also be used for mounting special brackets or supporting members for special test adapters.

2. Select the proper plug-in-unit for the frequency to be used for the measurement.

3. Loosen the two slotted head screws which are recessed one inch deep in the 1/4 inch champfered holes on the metallic

side plate. Do not turn any shallow recessed screws on this side plate. This separates the contact jaws which can be seen through two slots by opening the top of the cabinet and looking at the horizontal tube shelf.

4. Through the open top of the cabinet insert the large lugs of the plug-in-unit into the jaws just separated and the five prongs into the five pin receptacle adjacent to the metal tube 6AG7.

5. Tighten the six captive screws along the edges of the plug-in-unit and tighten the two deep recessed screws on the side plate which close the jaws on the lugs.

6. Set the controls to these positions:

MICROMHOS DIAL - zero (on range (1))
CONDUCTANCE RANGE - range (1)
MMF - zero
FINE TUNING - white dot at top
METER SENSITIVITY (lever switch) - LOW (keep this on LOW always except during a measurement)

7. Plug into 105-125V (60 cycles only) AC line (for operation on 115/230V, 50/60 cycles, use Type 192-AP)

8. Turn POWER ON. Heating lamp inside cabinet will go out and instrument will be ready for preliminary operation after a 15 minute warmup. For best accuracy, allow a longer warmup time for the first time (unless the heating lamp has been on) and keep spare plug-in-units inside the cabinet on the brackets provided for such storage. This will reduce warmup time when changing from one frequency to another.

9. After warmup period, depress BALANCE lever switch (lower right hand corner) to VOLTAGE and turn MMFD knob for maximum deflection of the meter to right. Holding key on voltage, operate VOLTAGE ADJ knob to produce a deflection to the 30 mark at right of zero on the meter. This puts 30 volts RMS at resonance on the test terminals of the instrument. These terminals are on the right hand side of the cabinet. The metallic plate is the ground terminal, and the round protruding boss with a tapped hole is the insulated high terminal. Release the BALANCE key to normal then put it in the upper or ZERO ADJ position and adjust mechanical zero of the panel meter if this is necessary.

10. Sensitivity Check.

Put the controls in the position noted under 5 above and put BALANCE LEVER SWITCH at BALANCE.

Turn BALANCE controls COARSE, MEDIUM and FINE to put meter on zero center. Touch up resonance by operating MMFD and FINE TUNING controls for maximum right hand deflection of meter. Repeat with METER SENSITIVITY lever switch on MEDIUM, then on HIGH.

Check sensitivity by rotating the MICROMHOS dial until the meter pointer moves from zero to ten left of zero. Read the conductance:

On 1 mc. this is from 0.003 to 0.004 μmhos (range 1)
On 30 mc. this is from 0.035 to 0.045 μmhos (range 2)

11. Return METER SENSITIVITY lever switch to LOW and MICROMHOS dial to ZERO, CONDUCTANCE RANGE switch to (1). Now the instrument is ready for use in making measurements.

B. METHOD for MEASURING TWO TERMINAL COMPONENTS

Component connected to binding posts.

Measuring Procedure - Unknown having parallel conductance and Capacitance and connected across terminals of instrument.

Range of Measurement:

At 1 mc: CONDUCTANCE RANGE 0.001 to 35 μmhos.
CAPACITANCE RANGE 0 to 100 μμf.

At 30 mc: CONDUCTANCE RANGE 0.05 to 35 μmhos (Figures I & II, pages 14 & 15)
CAPACITANCE RANGE 0 to 100 μμf.

Note on correction at 30 mc: A small correction on the measured conductance of the unknown is required to ascertain the true unknown conductance. This correction is a function of the unknown capacitance and its value is found from Figure I on page 14.

Procedure: (Assumes set has been placed in operation according to instructions in Section A. above.)

1. Set CONDUCTANCE RANGE at 1. MICROMHOS DIAL at 0. METER SENSITIVITY switch at LOW.

2. Connect unknown to terminals. Resonate with MMF dial for maximum right hand swing on METER. Use BALANCE CONTROLS to keep METER near ZERO on scale.

3. Press BALANCE lever switch to VOLTAGE and use VOLTAGE ADJ to put voltage approximately at 30 as indicated by pointer of meter swinging to right of zero. At 1 mc, the unknown with conductance greater than 20 micromhos, the maximum voltage available at terminals drops from 30 volts to approximately 20 volts at 35 micromhos. The instrument is accurate for all voltages above 15 volts.

4. Adjust BALANCE CONTROLS for balance (meter = 0). Refine resonance and balance with METER SENSITIVITY at MEDIUM, then at HIGH. Record MMF dial reading as C_1.

$$D = \frac{G}{\omega C}$$

$$G \sim G$$

$$M = DC = \frac{GC}{C} = G$$

$$D = \frac{G}{2\pi f C}$$

$$M = DC = \frac{GC}{2\pi f C} = \frac{G}{\omega}$$

5. Return METER SENSITIVITY to LOW. Remove unknown from terminals.

6. Re-resonate using MMF dial. Do not disturb setting of BALANCE CONTROLS but keep meter near zero using CONDUCTANCE RANGE and MICROMHOS CONTROLS. Refine resonance and zeroing of meter using MMFD and MICROMHOS knob first with MEDIUM and then with HIGH METER SENSITIVITY. Record MMF setting as C_2.

7. Record capacitance of unknown as $C_x = C_1 - C_2$. Record setting of micromhos dial as measured conductance of unknown G_x^1.

8. At 1 mc, $G_x^1 = G_x$ as no correction is necessary and the dissipation factor of unknown is given by:

$$D_x = .159 \frac{G_x}{FC_x} = \frac{1}{Q}$$

G_x = micromhos conductance of unknown
C_x = micromicrofarads
F = megacycles

9. At 30 mc, $G_x = G_x^1 + \delta G$ from chart Figure 5. on page 14. This corrects for both the apparent increase in conductance of unknown due to resistance of binding posts and the apparent decrease in conductance of unknown due to resistance of the variable condenser. Then at 30 mc:

$$D_x = .159 \frac{(G_x^1 + \delta G)}{FC_x} = .159 \frac{G_x}{FC_x} = \frac{G_x}{\omega C_x} \text{ (parallel)}$$

10. The Q_x of the unknown is given by:

$$Q_x = \frac{1}{D_x} = \frac{C_x}{.159 G_x}$$

C. METHODS for MEASURING DIELECTRIC DISC SAMPLES

I. Use of Dielectric Sample Holder (General Radio Type 1690-A).

a. Installation.

The GRC Type 512-A Adapter will mount this device on the Conductance Meter. Installation of the sample holder on the Conductance Meter is accomplished as follows:

1. Turn METER SENSITIVITY switch to LOW (if instrument is operating).

2. Remove the high and ground binding posts from the terminal plate and terminal boss.

3. Attach the outside threaded ring of the Adapter Type 512-A kit to the side plate of the Conductance Meter with four 6-32 screws, and screw in the small contact

into the threaded hole of the high contact boss. Be certain that the inside hole of the threaded ring is concentric about the center contact.

4. Slip the knurled ring over the piece having a 3/4" diameter thread and thread this part into either the bottom or side hole of the dielectric sample holder. If measurements are to be made with an air gap between the electrodes and the dielectric holder, use the side hole of the sample holder in order that the sample will not fall out. However, if the unknown is to be clamped between the electrodes of the sample holder, then the bottom hole of the holder may be used. Install the center connector with split spring contacts prongs in the appropriate hole of the sample holder.

5. After tightening the threaded pieces in place, carefully place and seat the sample holder on the adapter and tighten the knurled ring onto the threads of the threaded ring.

6. Back out the auxiliary vernier capacitor of the dielectric sample holder until it no longer meshes with the high electrodes. This is not used with the Conductance Meter.

7. The sample holder is now ready to use for either of two kinds of measurement; a clamped-specimen measurement, or air-gap specimen measurements.

b. Measurement Procedures.

Factors which affect choice of air-gap or clamped specimen type of measurement procedures.

Air-Gap Measurement Technique vs. Clamped Specimen Technique

Advantages of Air-Gap Technique

1. Error in conductance due to foil is eliminated.

2. Several measurements with different gaps can be measured and results averaged.

3. Samples which are not flat can be measured with better assurances as to accuracy of results.

4. Conductance of samples having a capacity of over 100 mmf can be measured on the conductance meter provided the actual capacitance of the sample is determined indirectly or from other direct measurements.

Disadvantages

A separate determination on the conductance meter of capacitance of samples is necessary in order to correct

the dissipation factor of the specimen alone. This must be done using a lead foil in order to get as exact as possible [illegible] since the foils are not in place when the conductance is measured, [illegible] eliminated.

The calculations are only slightly more involved for air-gap work than for clamped specimen work.

Range of Measurements

At 1 mc CONDUCTANCE RANGE 0.001 to 35 μmhos
CAPACITANCE RANGE 0 to 85 μμf

At 30 mc CONDUCTANCE RANGE 0.05 to 35 μmhos (note on correction)
CAPACITANCE RANGE 0 to 85 μμf

At 30 mc the inductance between the electrodes of the sample holder and the conductance substitution point in the conductance meter causes the unknown to appear as a [illegible] multiplying factor as a function of [illegible] spacing of the holder which will (at 30 mc) correct the measured large conductance down to the correct value.

7. Air-Gap [Foil-Lead] Measurement Procedure:

General: There are two parts to this measurement.

1st. Data is taken on C_a and G_a of the equivalent capacitor formed between the electrodes of the dielectric sample holder by the series combination of air-gap and specimen WITHOUT FOIL ELECTRODES. From this is calculated an effective dissipation factor: $D_a = \frac{0.159\ G_a}{FC_a}$. A number of values of D_a can be found using different air-gaps having corresponding values of C_a and G_a.

2nd. Only for the purpose of measuring capacitance, foil electrodes of soft-thin lead or aluminum are affixed to the specimen and its capacitance is determined. These data give the value C_x of the specimen.

Calculation: The calculation of D_x, the dissipation factor of the specimen is simply:

$$D_x = D_a \frac{C_a}{C_x}$$

Procedure: (Assumes Conductance Meter is properly in operation [pg. 1] and Dielectric Sample Holder is properly installed with its electrode faces horizontal (pg. 4).

1. Test Specimen - select a test specimen having a capacity in the range of 10 to 35 mmf. The preferred size is a disc 2" diameter by about 0.050 to 0.125" thick. However, this range of thickness can be extended to 0.030 to 0.150" thick with no serious error. Diameters under 2" are taken care of in the formula to follow. The specimen should be flat to within ±5% and should have clean surfaces and edges. The surfaces should be WITHOUT FOIL ELECTRODES for the first part of the measurement, however, for the second part of the measurement thin 1/4 mil soft lead or aluminum foil, petrolatum and a narrow rolling tool and razor for trimming should be available.

2. Place the test specimen in the 1690-A Sample Holder and adjust the main micrometer dial to provide an air-gap of from about 0.005" to 0.050" above the surface of the sample. Record this setting of micrometer dial as T_1.

3. Set Conductance Meter controls in these positions.

   METER SENSITIVITY - LOW
   CONDUCTANCE RANGE - 1
   MICROMHOS - 0
   MMF - tuned for maximum of resonance (greatest deflection of meter to right of zero). Do this with BALANCE Lever switch depressed to VOLTAGE position.
   VOLTAGE ADJ - set to give a +30 (30 volts) reading on meter at resonance with BALANCE lever switch depressed to VOLTAGE.
   Note: At 1 mc, samples with conductance over 20 micromhos load the resonant circuit so that at 35 micromhos only 20 volts reading can be obtained on the meter. Release BALANCE lever switch.

4. Refine resonance adjustment while keeping peak of resonance at zero on meter using progressively the COARSE, MEDIUM, and FINE TUNING BALANCE controls, and successively the MEDIUM and HIGH sensitivity position of the METER SENSITIVITY lever switch. Carefully place maximum swing of meter at zero on its scale. Note that the MMF dial is on its calibration range, not less than 0 or more than 100. Its reading need not be recorded here.

5. Put METER SENSITIVITY switch on LOW, remove sample from holder and re-resonate by closing up the spacing of the electrodes using the main micrometer lead. Do not disturb any panel controls on the Conductance Meter except CONDUCTANCE RANGE, MICROMHOS dial and METER SENSITIVITY switch. As resonance is approached, meter will swing to right. Keep meter zeroed by operating CONDUCTANCE RANGE and MICROMHOS controls as resonance is reached. Refine resonance setting with MEDIUM and HIGH METER SENSITIVITY.

6. Put METER SENSITIVITY switch on LOW.

7. Record second resonance setting of the sample holder micrometer as T_2 and the conductance dial reading as G_a^1. At 1 mc $G_a^1 = G_a$ conductance of sample with air-gap. At 30 mc ascertain value of M from Figure II on page 17 entering the chart with the value T_2 found. Then $G_a = MG_a^1$.

8. Calculate the capacitance C_a of the sample plus air-gap as follows:

$$C_a = C_2 + \Delta C_2 - \Delta C_1 - C_1 \left(1 - \frac{D_x^2}{4}\right)$$

C_a = Capacitance of sample plus air-gap.

C_2 = Geometric air capacitance at setting T_2 (see table I. on pg. 16.)

C_1 = " " " " " T_1

ΔC_2 = Correction for setting T_2)
ΔC_1 = " " " T_1) from correction charts 1690-A

D_x = Diameter inches of specimen

$\left(1 - \frac{D_x^2}{4}\right)$ = 0 for 2" diameter specimen, and

$$C_a = C_2 + \Delta C_2 - \Delta C_1$$

9. Calculate the dissipation factor of the sample plus air-gap.

as $$D_a = \frac{0.159\ G_a}{F_m}$$

10. Repeat above for other air-gaps if desired before putting foils on specimen for the measurement of capacitance, C_x. Measure the thickness of the specimen with a machinist micrometer at several places and average the readings. Call this T_{1x}.

11. Now put thin lead or aluminum foils (using soft temper material) on the specimen. Stick these on with petrolatum and roll out smoothly with a narrow roller. Trim the edges neatly with a razor blade without shaving off the edge of the specimen. Be certain that the foil makes good contact to the specimen over its surface, hence dead soft material should be used.

12. Put the sample with foils in sample holder and screw the top electrode down until it is firmly in contact

as indicated by release of the drive mechanism. Record not the setting T_1 of the sample holder, but the average thickness as measured by the micrometer, T_{1x}.

13. Put CONDUCTANCE RANGE at 1 and MICROMHOS dial at 0.

14. Resonate the Conductance Meter using the MMF dial as evidence by maximum swing of meter to right. Refine resonance with higher meter sensitivity, keeping meter at mid-scale zero using COARSE, MEDIUM and FINE BALANCE CONTROLS. Put METER SENSITIVITY switch at LOW. Check to see that MMF dial is on scale between 0 and 100 and not at part way up the resonance curve due to insufficient capacity range.

15. Remove sample from holder and re-resonate using micrometer screw of sample holder. As resonance is approached, keep meter at zero by advancing CONDUCTANCE RANGE and MICROMHOS dial. Refine resonance with higher meter sensitivity and record the resonance setting of sample holder as T_{2x}.

16. Calculate capacitance of sample with foils C_x as follows:

$$C_x = C_2 + \Delta C_{2x} - \Delta C_{1x} - C_{1x}\left(1 - \frac{D_x^2}{4}\right)$$

C_2 = Geometric air capacitance at setting T_{2x}. (From Table I, page 16)

C_{1x} = " " " " " T_{1x}.

ΔC_{2x} = Correction for setting T_{2x}.

ΔC_{1x} = " " " T_{1x}.

D_x , diameter inches of specimen. For 2" diameter $\left(1 - \frac{D_x^2}{4}\right) = 0$, and $C_x = C_2 + \Delta C_{2x} - \Delta C_{1x}$

17. Now for each value of D_a, calculate $D_x = D_a \frac{C_x}{C_a}$

18. Dielectric constant $K = \frac{C_x}{C_1} \frac{4}{D_x^2} = \frac{C_x}{C_1}$ for D_x = 2 inches.

2f. Example of Air-Gap Technique - Teflon Sample 2" diameter.

Air-Gap Data Frequency 30 mc

Thickness of sample = 0.123" (Averaged Micrometer Readings)

T_1 = 0.129 (Air-gap = .129-.123=.006")

T_2 = 0.069

G_a^1 = 0.288 μmhos

M = 0.976 (From Fig. II pg. 15, entering with T_2.)

G_a = 0.281 μmhos

Calculations

Now using T_1 and T_2 with data on pg 15, Figure II. and General Radio Correction Chart for holder.

A_x = area of specimen, A_e = area of electrode

C_1 (not needed) ΔC_1 = -0.06

$A_x = A_e$ hence $(1-\frac{A_x}{A_e}) = 0$

C_2 = 10.27 ΔC_2 = 0.09

C_a = 10.27 + .09 + .06 = 10.42

$D_a = \frac{.159 \times .281}{30 \times 10.42} = .000143$

Data With Foil Electrodes T_{1x} = 0.123

To get C_x T_{2x} = 0.0628

C_{1x} = 5.74 ΔC_{1x} = 0.05

C_{2x} = 11.25 ΔC_{2x} = 0.12

Final Calculations

C_x = 11.25 + 0.12 + 0.05 = 11.42

$D_x = D_a \frac{C_x}{C_1} = .000143 \times \frac{11.42}{10.42} = .000157$

This value .000157 does not include any conductance loss due to use of foils.

$$K = \frac{C_x}{C_1} = \frac{11.42}{5.74} = 1.99$$

By way of comparison, conductance of the same sample was measured with foils.

At [illegible] = 0.5-0 M = 0.975 G_x = 0.975x0.5-0 = 0.5[illegible]mhos.

This gives a dissipation factor of

$$D_x = \frac{0.159 \times 0.515}{[\text{illegible}] \times 11.4} = 0.000248$$ showing extra loss due to foils, when compared to 0.000157 without foils.

d. Measurement Procedure with Foils.

Use of General Radio Type 1690-A Sample Holder on the Conductance Meter.

Clamped-Specimen with Foils

Range of Measurement		1 mc	30 mc
At 1 mc	CONDUCTANCE	.001 to 35	.05 to 35* µmhos
	CAPACITANCE	0 to 85	0 to 85 µµf

* Note - 30 mc Conductance measurements yield a higher-than-correct value G_x because of the inductance between the faces of the electrodes and the conductance substitution point in the Conductance Meter. Figure 11 on page 25 gives the correction multiplier M which when multiplied by G_x yields the correct conductance G_x.

1. Preparation of Test Specimen.

Select a specimen having a capacity in the range of 10 to 85 µµf. The preferred size is a disc 2" diameter by about .050 to .125" thick, however, this range of thickness can be extended to .030 to .190. Specimen diameters of less than 2 inches can be accommodated to the formulae given below. The specimen should be flat to within ±5% or better, and before attaching the foil electrodes the thickness of the specimen should be measured at several places and the results averaged using a machinist's micrometer. Record this average thickness as T_1.

Coat each surface of the specimen with a thin film of petrolatum and attach a 1/4 mil thick foil of either soft copper, aluminum or lead.

At 1 mc the lead will probably be most satisfactory because it will have good conformance to the surface of the specimen. At 30 mc the copper foil will produce more accurate results because of lower losses in the metal. However, the copper must be soft enough to have good conformance to the surface of the specimen.

Roll the foil out with a narrow roller to have no wrinkles, and trim any excess off the edge so that the foil just covers the specimen surface. Keep the edges of the specimen clear so that leakage across the edges will not affect the results.

2. Set the Conductance Meter controls as follows:

METER SENSITIVITY - LOW
CONDUCTANCE RANGE - 1
MICROMHOS - 0

3. Place this specimen with foils in the sample holder and screw the top electrode down until it is firmly in contact as indicated by release of the drive mechanism.

4. Resonate the conductance meter using the MMF dial as evidenced by maximum swing of meter to right. Be certain that MMF dial is on scale for resonance between 0 and 100. If not, select a thicker or smaller diameter sample to reduce its capacity. The MMF dial reading need not be taken down as the capacity of the sample is obtained from micrometer reading of the 1690-A Sample Holder. Refine resonance using higher meter sensitivity. Keeping the meter at zero mid-scale using COARSE, MEDIUM and FINE BALANCE controls. Put METER SENSITIVITY switch on LOW and remove sample.

5. Re-resonate for maximum right-hand meter swing by closing up the electrode spacing of the sample holder using the MICROMETER SCREW. As resonance is approached, keep the meter at zero by increasing the MICROMHOS dial and CONDUCTANCE RANGE switch. Refine the resonance with MICROMETER SCREW until at HIGH METER SENSITIVITY, the peak of resonance is at zero on meter.

6. Record the spacing of the electrode of the sample holder as T_2. Record the conductance dial reading as $G_{\frac{1}{4}}$ [at 1 mc $G_X = G_{\frac{1}{4}}$]. From Figure II on page 15, determine M using T_2 (for 30 mc only). Calculate $C_X = MG_{\frac{1}{4}}$.

7. Calculate capacitance of sample C_X with foils as follows:

$$C_X = C_2 + \Delta C_2 - \Delta C_1 - C_1\left(1 - \frac{D_X^2}{4}\right)$$

or for a 2 inch diameter sample $C_X = C_2 + \Delta C_2 - \Delta C_1$

C_2 = Geometric air capacitance at setting T_2) from Table I
C_1 = " " " " " T_1) on page 16

ΔC_2 = Correction for setting T_2) from General
) 1690-A Corr
ΔC_1 = " " " T_1) Curves.

D_x = Diameter of sample in inches.

8. Calculate dissipation factor and dielectric constant of material.

Dissipation factor $D_x = \frac{0.159\ G_x}{FC_x}$

G_x = conductance in micromhos.

F = frequency in megacycles.

C_x = capacitance in micromicrofarads.

Dielectric constant $K = \frac{C_x}{C_1}$ $\frac{4}{\pi r^2}$

9. Example of use of Conductance Meter with a Teflon sample with silver foil electrodes at 30 mc.

Data Specimen diameter = 2"

Thickness = 0.123 (average of micrometer readings)

$T_1 = 0.123$ $T_2 = 0.0636$ $G_x^1 = 0.420$ $M = 0.976$

$C_1 = 5.74$ $\Delta C_1 = -0.05$ $G_x = MG_x^1$

$C_2 = 11.11$ $\Delta C_2 = 0.11$

$C_x = 11.11 + 0.11 + 0.05 = 11.27$

$G_x = MG_x^1 = 0.976 \times 0.420 = 0.410$

$= \frac{0.159 \times 0.410}{30 \times 11.27} = 0.000193$ $K = \frac{11.11}{5.74} = 1.93$

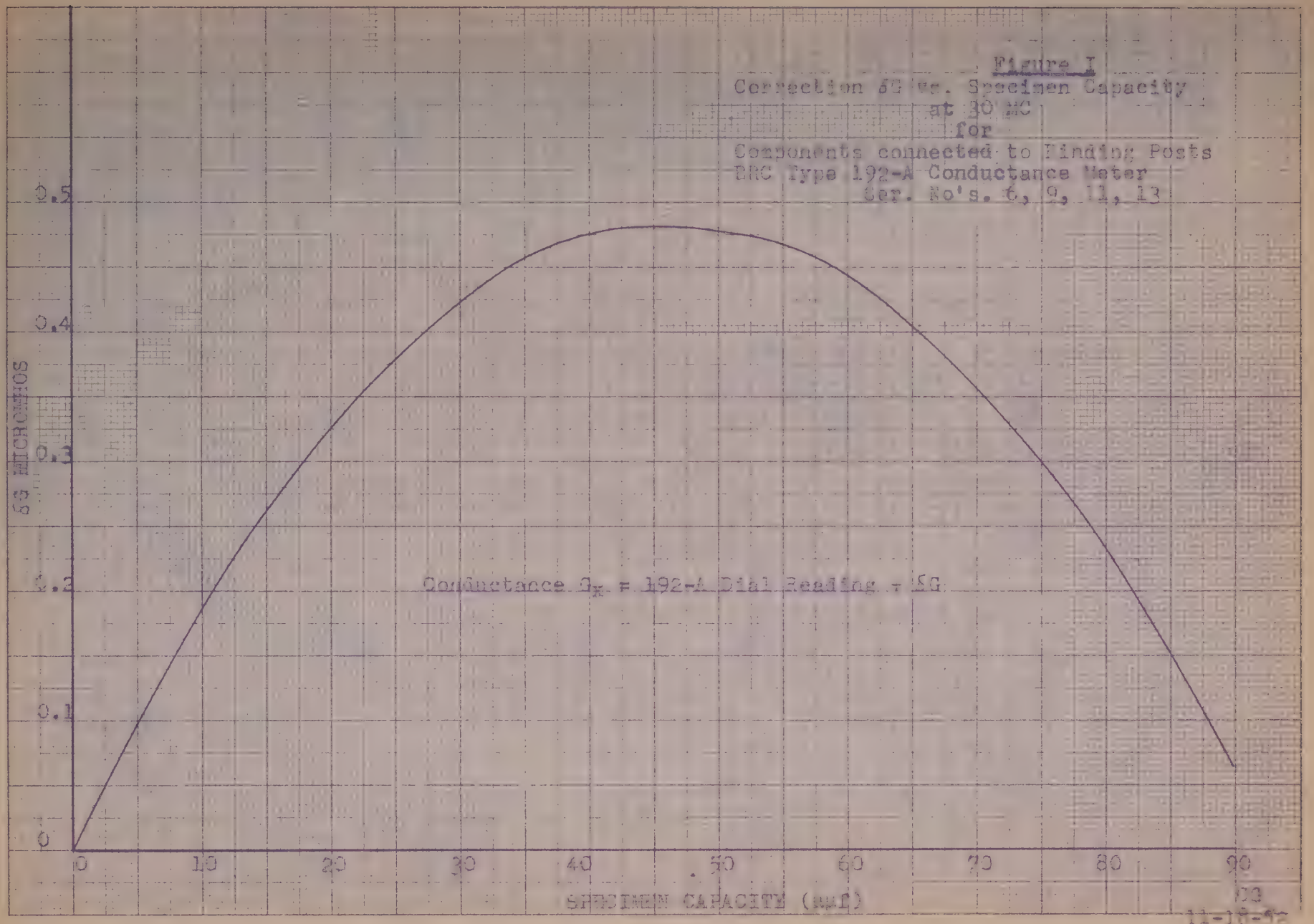
Figure I
Correction δG vs. Specimen Capacity
at 30 MC
for
Components connected to Binding Posts
DRC Type 192-A Conductance Meter
Ser. No's. 6, 9, 11, 13
δG MICROMHOS
0.5
0.4
0.3
0.2
0.1
0
Conductance G_x = 192-A Dial Reading + δG
0
10
20
30
40
50
60
70
80
90
100
SPECIMEN CAPACITY (μμf)
11-18-52

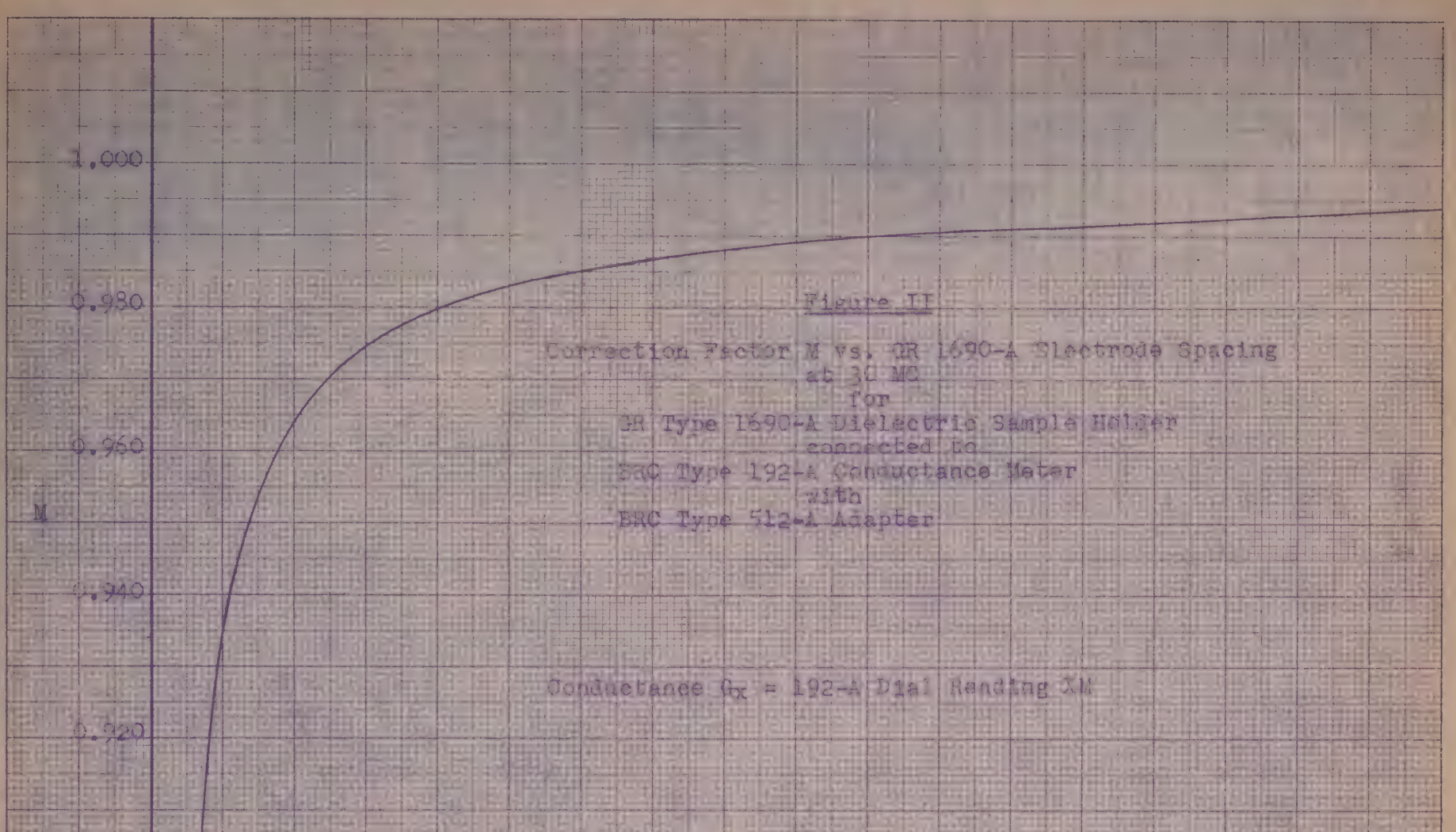

Figure II

Correction Factor M vs. GR 1690-A Electrode Spacing
at 30 MC
for
GR Type 1690-A Dielectric Sample Holder
connected to
GRC Type 192-A Conductance Meter
with
GRC Type 512-A Adapter

Conductance G_x = 192-A Dial Reading XM

					130.84	128.46	126.16	123.95			
					110.39	108.69	107.05	105.45	103.90	102.39	
					95.47	94.20	92.96	91.76	90.58	89.43	
					84.11	83.12	82.15	81.21	80.29	79.38	
								.84	72.		
								.03	65.		
				62.52	61.97	61.44	60.91	.39	59.8	59.	
				.44	56.98	56.52	56.07	.63			
				53.10	52.72	52.33	51.95	.7			
14				49.41	49.06	48.73	48.	.6			
				46.18	45.88	45.58	45.29	.0		44.	
				43.34	43.08						
			.08	40.84	40.60	40.37	40.14	39.92	39.69	39.47	
				38.61	38.40	38.19	37.98	37.78	37.58	37.	
				36.61	36.42	36.23	36.05	35.86	35.68	35.	
		.48	33.33	33.17	33.01	32.86	32.71	32.56	32.41	32.26	
		.58	30.45	30.32	30.19	30.06	29.94	29.81	29.69	29.56	
		29.32	29.19	29.07	28.96	28.84	28.72	28.60	28.49	28.37	
	26.17	26.07	25.97	25.8	25.79	25.69	25.60	25.51	25.41	25.32	
	24.36	24.26	24.20	24.11	24.03	23.95	23.87	23.79	23.71	23.	
	22.09	22.01	21.94	21.87	21.81	21.74	21.67	21.61			
33	21.41	21.34	21.28	21.22	21.15	21.09	21.03	2.			
	20.78	20.72	20.6	20.60	20.54	20.48	20.42	20.36			
35	20.19	20.13	20.07	20.01	19.96	19.90	19.85	19.79			
36	19.63	19.57	19.52	19.46	19.41	19.36	19.30	19.25	19.20	19.	

				8.58	8.57	8.56	8.55	8.54	8.53	
				8.48	8.47	8.46	8.45	8.44	8.43	
		.40	8.39	8.38	8.37	8.36	8.35	8.34	8.33	
		.30	8.29	8.28	8.27	8.26	8.25	8.24		
		.21	8.20	8.19	8.18	8.17	8.16	8.15	8.14	8.13
		.11	8.10	8.09	8.08	8.07	8.07	8.06	8.05	8.04
		.02	8.01	8.00	7.99	7.98	7.97	7.97	7.96	
		7.93	7.92	7.91	7.90	7.89	7.89	7.88	7.87	7.86
		7.84	7.83	7.82	7.82	7.81	7.80	7.79	7.78	7.77
		.76	7.75	7.74	7.73	7.72	7.71	7.70	7.70	7.69
								7.54	7.53	7.52
		.51	7.50	7.49	7.48	7.48	7.47	7.46	7.45	7.44
		.20	7.19	7.19	7.18	7.17	7.17	7.16	7.15	7.14

Table of Calculated Capacitance (Continued)

Mils	0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100	7.07	7.00	6.93	6.86	6.79	6.73	6.67	6.60	6.54	6.48	6.42
110	6.42	6.37	6.31	6.25	6.20	6.14	6.09	6.04	5.99	5.94	5.89
120	5.89	5.84	5.79	5.74	5.70	5.65	5.61	5.56	5.52	5.48	5.44
130	5.44	5.39	5.35	5.31	5.27	5.23	5.20	5.16	5.12	5.08	5.05
140	5.05	5.01	4.98	4.94	4.91	4.87	4.84	4.81	4.77	4.74	4.71
150	4.71	4.68	4.65	4.62	4.59	4.56	4.53	4.50	4.47	4.44	4.42
160	4.42	4.39	4.36	4.33	4.31	4.28	4.26	4.23	4.21	4.18	4.16
170	4.16	4.13	4.11	4.08	4.06	4.04	4.01	3.99	3.97	3.95	3.93
180	3.93	3.90	3.88	3.86	3.84	3.82	3.80	3.78	3.76	3.74	3.72
190	3.72	3.70	3.68	3.66	3.64	3.62	3.61	3.59	3.57	3.55	3.53
200	3.53	3.52	3.50	3.48	3.46	3.45	3.43	3.42	3.40	3.38	3.36
210	3.36	3.35	3.33	3.32	3.30	3.29	3.27	3.26	3.24	3.23	3.21
220	3.21	3.20	3.18	3.17	3.15	3.14	3.13	3.11	3.10	3.09	3.07
230	3.07	3.06	3.05	3.03	3.02	3.01	2.99	2.98	2.97	2.96	2.94
240	2.94	2.93	2.92	2.91	2.90	2.88	2.87	2.86	2.85	2.84	2.83
250	2.83	2.82	2.80	2.79	2.78	2.77	2.76	2.75	2.74	2.73	2.72
260	2.72	2.71	2.70	2.69	2.68	2.67	2.66	2.65	2.64	2.63	2.62
270	2.62	2.61	2.60	2.59	2.58	2.57	2.56	2.55	2.54	2.53	2.52
280	2.52	2.51	2.51	2.50	2.49	2.48	2.47	2.46	2.45	2.45	2.44
290	2.44	2.43	2.42	2.41	2.40	2.40	2.39	2.38	2.37	2.36	2.36

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